



18/10/2004

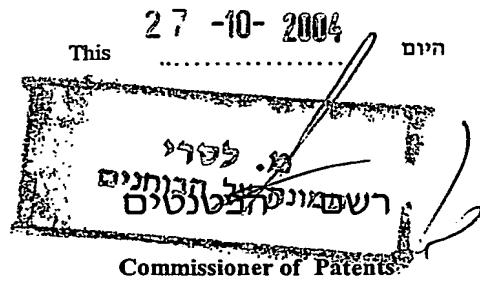
מדינת ישראל  
STATE OF ISRAEL

Ministry of Justice  
Patent Office

משרד המשפטים  
לשכת הפטנטים

This is to certify that  
annexed hereto is a true  
copy of the documents as  
originally deposited with  
the patent application  
particulars of which are  
specified on the first page  
of the annex.

זאת לטעודה כי  
רצופים בזאת העתקים  
נכוניים של המסמכים  
שהופקו לכתהילה  
עם הבקשה לפטנט  
לפי הפרטים הרשומים  
בעמוד הראשון של  
הנספח.



נתאשר  
Certified

BEST AVAILABLE COPY

לשימוש הלשכה  
For Office Use

חוק הפטנטים, תשכ"ז – 1967  
PATENT LAW, 5727 – 1967

מספר : Number	161487
תאריך : Date	19-04-2004
הוקדמת/נדחת Ante/Post-dated	

בקשה לפטנט  
Application for Patent

אני, (שם המבקש, מענו ולגבי גוף מאוגץ – מקומות התאגדותו)  
I (Name and address of applicant, and in case of body corporate-place of incorporation)

ELBIT SYSTEMS LTD.  
ADVANCED TECHNOLOGY CENTRE  
HOF HACARMEL, P.O. BOX 539  
HAIFA 31053, ISRAEL  
AN ISRAELI CORPORATION

אלביט מערכות בע"מ  
מרכז טכנולוגיה מתקדמת  
חו"ר הכרמל ת.ד. 539  
31053 חיפה

שםה הוא

Owner, by virtue of the law

בעל אמצעה מכח הדין  
of an invention the title of which is

עמדת ירי מרובת נשקיס לרכב משוריין  
(ב עברית) (Hebrew)

MULTIPLE WEAPON SYSTEM FOR AN ARMORED VEHICLE  
(באנגלית) (English)

hereby apply for a patent to be granted to me in respect thereof.

* בקשה חלוקה – Application for Division	* בקשה פטנט מוסף – Application for Patent Addition	דרישת דין קדימה Priority Claim		
מבקשת פטנט from Application	לבקשת/לפטנט to Patent/Appl.	מספר/סימן Number/Mark	תאריך Date	מדינת האגד Convention Country
No. dated _____ מספר מיום	No. dated _____ מספר מיום	158338	9 October 2003 (9/10/2003)	IL
<p>* ימי בch: פללי/<u>מיוחד</u> – רצוף-בזות / <u>עד יוגש</u> P.O.A.: general / individual – attached / to be filed later</p> <p>הוגש בענין _____</p>				
<p>המען למסירת מסמכים בישראל Address for Service in Israel בوروCHOV, קוראח, אליעזרי ושות', ערכבי דין ועורכי פטנטים, ת"ד 58100, קריית ענדים, תל אביב 61580</p> <p><b>BOROCHOV, KORAKH, ELIEZRI &amp; CO., Advocates &amp; Patent Attorneys, P. O. Box 58100, Tel-Aviv 61580 Israel</b></p>				
<p>חתימת המבקש Signature of Applicant</p> <p>היום <u>19</u> בחודש <u>April</u> שנות <u>2004</u> of the year This</p>				

BOROCHOV, KORAKH, ELIEZRI & CO.,  
By:

Eliav Korakh  
Advocate & Patent Attorney

Reference:

002298IL1

סימוכין:

לשימוש הלשכה  
For Office Use

טופט זה כshawa מוטבע בחותם לשכת הפטנטים ומוסלים במספר ובתאריך ההגשה, הנה אישור להגשת הבקשה שפטנטית ורשומים לעיל.  
This form, impressed with the Seal of the Patent Office and indicating the number and date of filing, certifies the filing of the application,  
the particulars of which are set out above.

Delete whatever is inapplicable

\*מחק את המיותר

**עמדת ירי מרובת נשキים לרכב משוריין**

**MULTIPLE WEAPON SYSTEM FOR  
AN ARMORED VEHICLE**

Applicant: Elbit Systems Ltd.  
Agent: Borochov, Korakh, Eliezri & Co.  
Agent Ref: 002298IL1

## MULTIPLE WEAPON SYSTEM FOR AN ARMORED VEHICLE

### FIELD OF THE DISCLOSED TECHNIQUE

The disclosed technique relates to ammunition in general, and to  
5 methods and systems for activating a plurality of weapons from an  
armored vehicle, in particular.

### BACKGROUND OF THE DISCLOSED TECHNIQUE

It is necessary to move the weapon of a vehicle, such as a  
10 cannon or a gun of a tank, a sub-machine gun on an armored vehicle, and  
the like, in order to place the weapon at the desired firing position.  
Systems and methods for changing the firing position of such a weapon  
are known in the art.

US Patent No. 4,326,446 issued to Magnuson, and entitled  
15 "Linkage of Actuating System for Elevating Gun Mount", is directed to a  
mechanism for elevating a gun from a tracked military vehicle. The  
mechanism includes a bracket secured to a turret of the tracked military  
vehicle, a lever, a first power cylinder, a second power cylinder, and a  
20 toggle linkage. The toggle linkage includes a relatively long link and a  
relatively short link. The bracket includes a first bracket pivot connection, a  
second bracket pivot connection and a third bracket pivot connection. The  
relatively short link includes a first short link pivot connection, a second  
short link pivot connection and a third short link pivot connection. The

relatively long link includes a first long link pivot connection and a second long link pivot connection. The lever includes a first lever pivot connection and, second lever pivot connection and a third lever pivot connection. A receiver of the gun includes a first receiver pivot connection and a second receiver pivot connection.

The first lever pivot connection is connected to the first bracket pivot connection with a first pin. The second lever pivot connection is connected to the second short link pivot connection and to the first receiver portion of the gun, by a second pin. A first cylinder connection of the first power cylinder is connected to the third bracket pivot connection by a third pin. A first piston rod connection of the first power cylinder is connected to the third lever pivot connection by a fourth pin. A second cylinder connection of the second power cylinder is connected to the third short link pivot connection by a fifth pin. A second piston rod connection of the second power cylinder is connected to the second receiver connection by a sixth pin. The first long link pivot connection is connected to the first short link pivot connection by a seventh pin. The second long link pivot connection is connected to the second bracket pivot connection by an eighth pin.

The imaginary horizontal planes of the first short link connection and the second short link connection are spaced apart by a first vertical spacing. The imaginary horizontal planes of the third short link pivot connection and the second receiver pivot connection are spaced apart by

a second vertical spacing. The mechanism is constructed such that the first vertical spacing is the same as the second vertical spacing. In order to raise the gun vertically above the turret and maintaining the gun horizontal, the first power cylinder is activated and the second power cylinder is 5 de-activated. In order to change the elevation of the gun, the second power cylinder is activated and the first power cylinder is de-activated.

US Patent No. 4,446,772 issued to Eggers et al., and entitled "Large-Bore Twin-Weapon System for Combat Vehicles", is directed to a system for lifting a carrier of two weapons of a combat vehicle. The system 10 includes the carrier, a first pivot, a second pivot, a third pivot, lifting means, aiming drives, a main support bearing, a step bearing, a journal, an eccentrically formed bearing ring, a first support arm, a second support arm and a hydro-accumulator.

The two weapons are supported rotatably at the carrier. The first 15 pivot and the second pivot are connected to the carrier by the first support arm and the second support arm, respectively. The first pivot and the second pivot are connected to the combat vehicle. The lifting means is connected to the carrier, to the third pivot and to the hydro-accumulator. The third pivot is connected to the combat vehicle. The aiming drives, the 20 main support bearing, the step bearing and the journal are located within the carrier. The aiming drive is located between the main support bearing and the step bearing. The journal is connected to the weapon and to the aiming drive.

The position of the journal and the weapon are altered when the eccentrically formed bearing ring of the step bearing is rotated. In this manner the weapons are point-aimable to a predetermined distance. The aiming drive transmits a torque to the journal for changing the elevation of  
5 the weapon. The first pivot and the second pivot are located on a first rotating axis, and the third pivot is located on a second rotating axis. The carrier and the weapons are lifted by the action of the hydro-accumulator, the lifting means and the third pivot. Each weapon is height-aimable independently. The lateral aiming of the weapons is affected by rotation of  
10 the combat vehicle about a height axis, or by a rotary device on the combat vehicle.

US Patent No. 4,601,230 issued to LeBlanc and entitled "Weapon System", is directed to a manually operated multiple weapon system for an armored vehicle turret. The system includes a main gun, a  
15 coaxial machine gun, two four barrel automatic grenade launchers, a turret, a basket assembly, a rotor mounting assembly and a hydraulic cylinder means. The turret is mounted on a roof portion of the armored vehicle. The basket assembly depends from the turret. The rotor mounting assembly is mounted to the turret. The main gun, the coaxial machine gun  
20 and the automatic grenade launchers are attached to the rotor mounting assembly.

The basket assembly accommodates a gunner and a commander. The basket assembly includes an ammunition storage box for

feeding ammunition to the main gun, linked ejection chutes, a compartment and a manual elevation and trigger assembly. The linked ejection chutes guide the ejected ammunition links from the main gun through the rotor mounting assembly, into the compartment. The compartment opens to the outside of the armored vehicle for ejection of the propellant gases and the brass and rounds of the main gun. A machine gun ammunition storage box is positioned in the turret for feeding ammunition to the coaxial machine gun, through machine gun feed chutes. The hydraulic cylinder means is pivotally attached to the rotor mounting assembly and to the turret. The extension and retraction of the hydraulic cylinder means rotates the rotor mounting assembly.

The manual elevation and trigger assembly includes a handle, a pump, a gear box assembly and a trigger button. By operating the manual elevation and trigger assembly, the gunner manually elevates and fires the main gun. As the handle is turned, the gear box assembly is turned, thereby activating the pump and pressurizing the hydraulic cylinder means. When the trigger button is depressed the main gun fires, and when the trigger button is released, the firing stops.

US Patent No. 4,616,127 issued to Whitting and entitled "Fire Control System for a Vehicle or Vessel", is directed to a fire control system for a vehicle to compensate for the roll, pitch and yaw motions of the vehicle, and provide the true target motion to the gun, despite the gun

recoil and the rocking motions of the vehicle driving on hilly ground. The vehicle is fitted with a spring-suspended chassis on pneumatic tires.

The fire control system includes a turret, a gun, a target tracking unit, a plurality of servo control units, reference orientation means, a plurality of angle data transmitters, a data processor and a fire control computer. The target tracking unit includes a radar tracking apparatus, a laser range detector, an infrared tracking unit, a TV tracking unit and optical detection means. The fire control computer includes an aiming point generator, a first coordinate conversion unit and a transformation unit.

The gun is mounted on the turret. The turret is rotatable about a first axis perpendicular to a roof of the vehicle. The gun is movable in elevation about a second axis parallel to the roof. The target tracking unit is biaxially connected with the turret. The target tracking unit can rotate about a third axis parallel or coaxial with the first axis, and about a fourth axis parallel with the roof.

The servo control units are connected with the turret, the gun, the target tracking unit, the data processor and with the fire control computer. The reference orientation means and the angle data transmitters are connected to the turret, the gun, the target tracking unit and with the fire control computer. The data processor is connected with the target tracking unit and with the fire control computer.

The fire control computer calculates aiming values for the gun, according to the angle and range data from the target tracking unit, and according to orientation data from the reference orientation means. The fire control computer operates the servo control units according to the 5 calculated aiming values.

US Patent No. 6,269,730 issued to Hawkes et al., and entitled "Rapid Aiming Telespresent System" is directed to a system for remotely aiming a firearm at a target. The system includes a hand controller, display means, a pointing device and a control unit. The hand controller includes a 10 portable viewfinder, a two-axis joystick, stereo headphone speakers, visual indicators, a tactile signal generator, and a plurality of controls. The display means includes two computer display screens. The pointing device includes a firearm, a carriage, a base, a first rotational mount, a second rotational mount, a first linear actuator and a second linear actuator. The 15 control unit includes a microprocessor.

The firearm is mounted to the carriage. The carriage is connected to the base by the first rotational mount and the second rotational mount. The first linear actuator is attached to the base and to the carriage. The second linear actuator is attached to the first rotational 20 mount and to the carriage. The first rotational mount rotates the carriage along a first axis which is approximately vertical. The second rotational mount rotates the carriage along a second axis which is approximately horizontal.

The hand controller is connected to the control unit by a transmission cable. The control unit transmits electrical control signals to the first linear actuator and to the second linear actuator, via control signal transmission means. The computer display screens display a live video image of the area in the vicinity of the target as well as the current pointing direction. The user operates the hand controller according to the images on the computer display screens. The control unit sends electrical control signals to the first linear actuator and the second linear actuator, to actuate the first linear actuator and the second linear actuator, according to the signals received from the hand controller. The first linear actuator and the second linear actuator move the carriage along the first axis and the second axis, respectively. The control unit produces a first audio signal and a second audio signal at the stereo headphone speakers, according to the actuation speed of the first linear actuator and the second linear actuator, respectively.

## SUMMARY OF THE DISCLOSED TECHNIQUE

It is an object of the disclosed technique to provide a novel system for moving the weapons of a land vehicle to different configurations.

5 In accordance with the disclosed technique, there is thus provided a land vehicle weapon system which includes a base mount, a weapon mount, a plurality of weapons, a weapon moving mechanism, a plurality of moving elements, a sensing mechanism, and at least one user interface. The base mount is coupled with the land vehicle. The weapons  
10 are coupled with the weapon mount. The weapon moving mechanism is coupled between the base mount and the weapon mount.

The moving elements are coupled with at least one of the base mount, the weapon mount, the weapons, and with the weapon moving mechanism. The sensing mechanism is coupled with at least one of the  
15 weapon mount, the weapons and with the base mount. The user interface is coupled with the weapons, the weapon moving mechanism, the moving elements, and with the sensing mechanism. The weapon moving mechanism is operable to move the weapons between a plurality of configurations, and the user interface enables a user to remotely operate  
20 the weapons.

## BRIEF DESCRIPTION OF THE DRAWINGS

The disclosed technique will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

5 Figure 1 is a perspective view of an exposed portion of a land vehicle weapon system in a static firing configuration, constructed and operative in accordance with an embodiment of the disclosed technique, and installed on a land vehicle;

10 Figure 2 is a schematic illustration of a block diagram of the land vehicle weapon system of Figure 1;

Figure 3 is a perspective front view of the exposed portion of the land vehicle weapon system of Figure 1, in a static firing configuration;

15 Figure 4 is a perspective rear view of the exposed portion of the land vehicle weapon system of Figure 1, in another static firing configuration;

Figure 5A is a perspective top view of the exposed portion of the land vehicle weapon system of Figure 1, in a transportation configuration;

20 Figure 5B is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1, in the transportation configuration of Figure 5A;

Figure 5C is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in a combined configuration;

Figure 5D is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in another combined configuration;

5 Figure 5E is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in a further combined configuration;

Figure 5F is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in a further static firing configuration;

10 Figure 6A is a schematic side view illustration of the weapon of the system of Figure 1, in another transportation configuration;

Figure 6B is a schematic side view illustration of the weapon of the system of Figure 1, in another static firing configuration;

15 Figure 6C is a schematic side view illustration of the weapon of the system of Figure 1, in another combined configuration;

Figure 7 is a detail front perspective view of the exposed portion of the system of Figure 1, in a further static firing configuration and at a positive elevation;

20 Figure 8A is a perspective front view of the exposed portion of the system of Figure 1, in another combined configuration; and

Figure 8B is a detail perspective side view of the exposed portion of the system of Figure 1, in the combined configuration of Figure 8A.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

The disclosed technique overcomes the disadvantages of the prior art by providing a system which includes a plurality of weapons, wherein each weapon can be operated remotely from inside of the land vehicle. The system includes a mechanism for lowering the weapons to a retracted configuration, and for raising the weapons back to a combat configuration.

The term "land vehicle" herein below refers to an armored vehicle as well as a non-armored vehicle which can travel on ground. The land vehicle can be an unmanned vehicle (i.e., autonomously operated or remote controlled) as well as a vehicle occupied and operated by a human being. The land vehicle can move on wheels (i.e., wheel driven), on caterpillar traction (i.e., track driven, such as a tank), or a combination thereof. The term "elevation" herein below refers to the angular distance of a weapon relative to the horizon. Hence, a positive elevation refers to an angle above the horizon, and a negative value refers to an angle below the horizon. The term "azimuth" herein below refers to the horizontal direction of the weapon expressed as an angle relative to a reference direction..

The term "roof" herein below, refers to a panel of the land vehicle to which the weapon system is attached (e.g., the top surface of the land vehicle, the side surface of the land vehicle). Accordingly, the term "height" herein below, refers to a distance away from the roof.

Reference is now made to Figures 1, 2, 3 and 4. Figure 1 is a perspective view of an exposed portion of a land vehicle weapon system in a static firing configuration, generally referenced 100, constructed and operative in accordance with an embodiment of the disclosed technique, 5 and installed on a land vehicle generally referenced 102. Figure 2 is a schematic illustration of a block diagram of the land vehicle weapon system of Figure 1. Figure 3 is a perspective front view of the exposed portion of the land vehicle weapon system of Figure 1, in a static firing configuration. Figure 4 is a perspective rear view of the exposed portion of 10 the land vehicle weapon system of Figure 1, in another static firing configuration.

System 100 includes an automatic grenade launcher 104, a missile launcher 106, a primary gun 108, a secondary gun 110, a chemical compound dispenser 112, sensing mechanisms 114 and 116, a laser designator 118, controllers 120 and 122, an stabilization system 124, a user interface 126, a base mount 128 (Figures 3 and 4), a weapon mount 130, a weapon moving mechanism 132, a plurality of moving elements (not shown), ammunition cartridges 134 and 136, and one or more gyros (not shown). In the description herein below, automatic grenade launcher 15 104, missile launcher 106, primary gun 108, secondary gun 110, chemical compound dispenser 112, sensing mechanisms 114 and 116, and laser designator 118 are collectively referred to as "weapons". It is noted that 20 system 100 can include other types of weapon systems (e.g., a simple

automatic grenade launcher) camouflage units, imaging systems, and the like.

Automatic grenade launcher 104 launches a plurality of smoke grenades, explosive grenades, and the like, toward the target. Missile launcher 106 launches a plurality of missiles, such as land-to-land missile, land-to-air missile, antitank missile, guided missile, target-tracking missile, and the like, toward the target. Primary gun 108 is a canon, mortar, and the like. Secondary gun 110 is a machine gun, sub-machine gun, coaxial machine gun, rifle, and the like. Chemical compound dispenser is a device which dispenses a chemical compound toward the target, such as smoke (e.g., to reduce visibility), a gas (e.g., tear gas, nitrogen oxide - NO), a foam (e.g., to solidify upon contact and to immobilize the suspect), a liquid (e.g., high pressure water to counteract riots, a compound which forms into a web around the suspect and immobilizes him), and the like.

15 Each of sensing mechanisms 114 and 116 includes either one or more sensors or one or more imaging systems. The sensor is a laser sensor, sonic sensor, radar sensor, and the like, for example for determining the range of the target (i.e., a range-finder). Alternatively, the sensor is a mechanical sensor for example for determining the velocity, 20 acceleration, elevation, azimuth, and the like.

The imaging system is a charged-coupled device (CCD), video camera, and the like. The video camera can operate either in a visible range of wavelengths or a non-visible range of wavelengths, such as far

infrared, near infrared, and the like (e.g., night-vision camera, forward looking infrared radiometer – FLIR). The imaging system can be employed for aiming automatic grenade launcher 104, missile launcher 106, primary gun 108, secondary gun 110, chemical compound dispenser 112, and 5 laser designator 118 toward the target, for observation, for target acquisition, and the like.

Laser designator 118 is a device which directs laser toward the target for a missile (not shown), to lock on the target. The missile can be launched either from land vehicle 102, or from another location on the 10 Earth, such as land, sea, air or an ice bed.

Each of controllers 120 and 122 can include a respective processor (not shown). Controller 122 includes a target tracking system (not shown), which operates according to signals received from sensing mechanisms 114 and 116, to track the target. Stabilization system 124 15 operates in conjunction with the target tracking system, in order to stabilize the orientation of the weapons. Stabilization system 124 stabilizes the orientation of the weapons according to the movement of land vehicle 102, in order to substantially keep the weapons locked on to the target (not shown), in spite of the movement of land vehicle 102. For this purpose, 20 stabilization system 124 can include a plurality of modules 138 and 140, for example to stabilize the elevation and the azimuth of the weapons. In addition, stabilization system 124 can include one or more moving elements and one or more sensing mechanisms, to provide the required

stabilization. A first communication interface can be coupled with controller 120 and a second communication interface can be coupled with controller 122, thereby enabling controllers 120 and 122 to communicate either via a conductive path, or a wireless path.

5        Each of the moving elements can be in the form of an electric actuator (e.g., rotary electric motor, linear electric motor, electromagnet), hydraulic actuator (e.g., hydraulic cylinder, hydraulic motor), pneumatic actuator (e.g., pneumatic cylinder), and the like. Each of the moving elements can include power transmission elements, such as gears, 10 pulleys, belts, bearings, links, and the like. Ammunition cartridges 134 and 136 include a plurality of shells, bullets, and the like, to be loaded into primary gun 108 and secondary gun 110, respectively.

15      User interface 126 includes a plurality of visual interfaces 142 and 144 and a plurality of tactile interfaces 146 and 148. Each of visual interfaces 142 and 144 can be a television display, screen touch display, head-up display (HUD), biocular display, stereoscopic display, autostereoscopic display, binocular display, periscope, and the like. Each of tactile interfaces 146 and 148 can be a keyboard, joystick, switch, touchpad, conductive tablet and wand, and the like. User interface 126 can 20 include an audio device such as a microphone (not shown), speaker (not shown), and the like. User interface 126 can also include a haptic device (not shown), to provide a sense of force, velocity, acceleration, surface roughness, and the like, to the user (not shown).

Weapon moving mechanism 132 is in form of a four bar linkage which includes a first link 162, a second link 164 and a third link 166, where base mount 128 forms the fourth link. First link 162 is coupled with base mount 128 at a first joint 168, while third link 166 is coupled with 5 base mount 128 at a second joint 170. Second link 164 is coupled with first link 162 and with third link 166. Weapon mount 130 is coupled with first link 162. Each of the moving elements can be in form of an actuator (not shown). The actuator is coupled with first link 162, in order to rotate first link 162 about first joint 168. Additional actuators can be coupled with 10 weapon moving mechanism 132, for example at second joint 170.

\$The weapons are exposed and located external to land vehicle 102. Controller 122 and user interface 126 are located within a hull 150 of land vehicle 102.

System 100 can include an electric power supply – not shown 15 (either alternating current or direct current), non-rechargeable battery, rechargeable battery, fuel cell, renewable power supply (e.g., photovoltaic system, solar thermal electric system, wind operated turbine), non-renewable power supply (e.g., based on fossil fuel, alcohol, methanol, natural gas, radioactive material), and the like. Alternatively, each of the 20 weapons, controllers 120 and 122, stabilization system 124, user interface 126, weapon moving mechanism 132, and the moving elements can include a connector to be connected to the power supply (not shown) of land vehicle 102.

Controller 120 is coupled with the weapons, controller 122, stabilization system 124, weapon moving mechanism 132 and with the moving elements, either by a conductive, a wireless link, or a combination thereof. Controller 122 is coupled with user interface 126 either by a 5 conductive, a wireless link, or a combination thereof.

Base mount 128 is coupled with land vehicle 102. Weapon moving mechanism 132 is coupled between base mount 128 and weapon mount 130. The weapons, stabilization system 124, and the respective moving elements are coupled with weapon mount 130. Ammunition cartridge 134 is coupled with base mount 128 and with primary gun 108. 10 Ammunition cartridge 136 is coupled with secondary gun 110. The respective moving elements are coupled with weapon moving mechanism 132 and with base mount 128.

Base mount 128 can rotate in a full circle about a vertical axis 152 (Figure 1) substantially perpendicular to a longitudinal axis 154 of land vehicle 102, with the aid of the moving elements. In this manner, the azimuth of the weapons can be changed.

Weapon moving mechanism 132 moves the weapons to any of the following configurations:

20 • Transportation configuration, wherein the weapons lie horizontally substantially close to a roof 160 (Figure 1) of land vehicle 102, as described herein below in connection with Figures 5A and 6A. At this configuration the overall height of

land vehicle 102 is low enough to enter the cargo bay (not shown) of a cargo vehicle.

- Static firing configuration, wherein the weapons are at the maximum height and in a configuration suitable for combat, as illustrated in Figures 3 and 4 and described herein below in connection with Figure 6B,
- Combined configuration, wherein the weapons are at one of a plurality of configurations between the transportation configuration and the static firing configuration, and still in a configuration suitable for combat, as described herein below in connection with Figures 8A and 8B.

Furthermore, each of the weapons can include a moving element for changing the elevation of the respective weapon at the static firing configuration and at the combined configuration, wherein weapon mount 130 is substantially stationary relative to weapon moving mechanism 132. In addition or alternatively, the moving elements change the elevation of the weapons at the static firing configuration and at the combined configuration, wherein weapon mount 130 moves relative to weapon moving mechanism 132. Weapon moving mechanism 132 moves weapon mount 130 and thus the weapons, along vertical axis 152 (Figure 1), thereby varying the height of the weapons above roof 160. Thus, with the aid of user interface 126, the user can remotely and from the inside of land vehicle 102, operate either one of the weapons, move the weapons to

any of the transportation configuration, static firing configuration, or combined configuration, and adjust the elevation of the weapons at the static firing configuration or the combined configuration.

Reference is further made to Figures 5A, 5B, 5C, 5D, 5E and 5F. Figure 5A is a perspective top view of the exposed portion of the land vehicle weapon system of Figure 1, in a transportation configuration. Figure 5B is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1, in the transportation configuration of Figure 5A. Figure 5C is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in a combined configuration. Figure 5D is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in another combined configuration. Figure 5E is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in a further combined configuration. Figure 5F is a detail perspective side view of the exposed portion of the land vehicle weapon system of Figure 1 in a further static firing configuration.

Weapon moving mechanism 132 is a mechanism which moves weapon mount 130 and the weapons, from the transportation configuration (Figure 5A) to the static firing configuration (Figure 5F), and back (i.e., to a plurality of combined configurations), along vertical axis 152 (Figure 1), while the weapons remain substantially horizontal with roof 160 (Figure 1) of land vehicle 102. Alternatively, at each of these combined

configurations, the respective moving element can change the elevation of either one of the weapons, as illustrated in Figure 3, and as described herein below in connection with Figure 6B. It is noted that lowering of the exposed portion of system 100 toward roof 160 to the transportation configuration, reduces the volume occupied by land vehicle 102, thereby making possible for land vehicle 102 to enter a confined space, such as a cargo bay (not shown) of an aircraft (not shown), marine vessel (not shown), rail vehicle (not shown), and the like.

Reference is further made to Figures 6A, 6B and 7. Figure 6A is a schematic side view illustration of a weapon, generally referenced 156, of the system of Figure 1, in another transportation configuration. Figure 6B is a schematic side view illustration of the weapon of the system of Figure 1, in another static firing configuration. Figure 6C is a schematic side view illustration of the weapon of the system of Figure 1, in another combined configuration. Figure 7 is a detail front perspective view of the exposed portion of the system of Figure 1, in a further static firing configuration and at a positive elevation.

With reference to Figure 6A, weapon 156 is in a transportation configuration and at a substantially zero elevation. With reference to Figure 6B, weapon moving mechanism 132 has moved weapon 156 to a static firing configuration. At this static firing configuration, the moving element (not shown) can vary the elevation of weapon 156 between an angle  $\alpha_1$  below the horizon (reference 158), to another angle  $\alpha_2$  above the

horizon, where  $\alpha_2 > \alpha_1$ . With reference to Figure 6C, weapon moving mechanism 132 has moved weapon 156 to a combined configuration. At this combined configuration, the moving element can vary the elevation of weapon 156 between an angle  $\theta_1$  below the horizon, to another angle  $\theta_2$  above the horizon, where  $\theta_2 > \theta_1$ ,  $\alpha_2 > \theta_2$ , and  $\alpha_1 = \theta_1$ .

Reference is further made to Figures 8A and 8B. Figure 8A is a perspective front view of the exposed portion of the system of Figure 1, in another combined configuration. Figure 8B is a detail perspective side view of the exposed portion of the system of Figure 1, in the combined configuration of Figure 8A. At the combined configuration, the weapons of system 100 are functional for combat, notwithstanding the range of elevations of the weapons are less than that of the static firing configuration.

It is noted that in the static firing configuration, as illustrated in any of Figures 1, 3, 4, 5F, 6B, and 7, the height of weapon mount 130 from roof 160 (i.e., static firing height), is greater than the height of weapon mount 130 from roof 160 in the transportation configuration (i.e., transportation height), as illustrated in any of Figures 5A, 5B, 6A, 8A, and 8B. Thus, in the static firing configuration, the weapons can be moved within a range of angles  $\alpha_2$  (Figure 6B) above the horizon, which is greater than in the case of the transportation configuration.

It is further noted that the vehicle surface on which system 100 is to be installed does not need to be modified (e.g., by producing a hole,

such as in conventional systems which place some of the mechanisms inside the vehicle). All of the mechanisms of system 100 are placed outside the vehicle. The only modifications necessary are directed at affixing system 100 to the selected vehicle surface. With reference to

5 Figure 1, base mount 128 can be fixed to roof 160 by different welding techniques as known in the art, by employing an adhesive, and the like, or a combination of fasteners (not shown), welding, and adhesives. Alternatively, base mount 128 can be installed onto roof 160 with the aid of a plurality of fasteners, such as bolts, screws, rivets, pins, and the like, 10 which are inserted into respective small drilled or cast holes.

It will be appreciated by persons skilled in the art that the disclosed technique is not limited to what has been particularly shown and described hereinabove. Rather the scope of the disclosed technique is defined only by the claims, which follow.

## CLAIMS

## 1. Land vehicle weapon system comprising:

a base mount coupled with a land vehicle;

a weapon mount;

5 a plurality of weapons coupled with said weapon mount;

a weapon moving mechanism coupled between said base mount and said weapon mount, said weapon moving mechanism being operable to move said weapons between a plurality of configurations;

10 a plurality of moving elements coupled with at least one of said base mount, said weapon mount, said weapons, and with said weapon moving mechanism;

a sensing mechanism coupled with at least one of said weapon mount, said weapons and said base mount; and

15 at least one user interface coupled with said weapons, said weapon moving mechanism, said moving elements, and with said sensing mechanism, said at least one user interface enabling a user to remotely operate said weapons.

## 2. The system according to claim 1, wherein said weapon moving

20 mechanism moves said weapons to a combined configuration, between a transportation configuration and a static firing configuration.

3. The system according to claim 1, wherein said weapons are selected from the list consisting of:

canon;

mortar;

5 machine gun;

sub-machine gun;

coaxial machine gun;

rifle;

missile launcher; and

10 automatic grenade launcher.

4. The system according to claim 1, further comprising a chemical compound dispenser coupled with said weapon mount.

15 5. The system according to claim 4, wherein said chemical compound dispenser dispenses a chemical compound selected from the list consisting of:

smoke;

gas;

20 foam; and

liquid.

6. The system according to claim 1, wherein each of said moving elements is selected from the list consisting of:

electric actuator;  
mechanical actuator;  
5 hydraulic actuator; and  
pneumatic actuator.

7. The system according to claim 1, wherein said sensing mechanism comprises at least one sensor.

10 8. The system according to claim 7, wherein said at least one sensor is selected from the list consisting of:

laser sensor;  
sonic sensor;  
15 radar; and  
mechanical sensor.

9. The system according to claim 1, wherein said sensing mechanism comprises an imaging system.

10. The system according to claim 9, wherein said imaging system is selected from the list consisting of:

charge-coupled device; and

video camera.

5

11. The system according to claim 10, wherein said video camera operates in a visible range of wavelengths.

10 12. The system according to claim 10, wherein said video camera operates in a non-visible range of wavelengths.

13. The system according to claim 1, wherein the type of said at least one user interface is selected from the list consisting of:

15 tactile;

visual;

audio; and

haptic.

14. The system according to claim 1, wherein said at least one user 20 interface is located within said land vehicle.

15. The system according to claim 1, further comprising a target tracking system coupled with said weapon mount.

16. The system according to claim 1, further comprising a laser  
designator coupled with said weapon mount.

5 17. The system according to claim 1, wherein at least one of said moving  
elements rotates said base mount about a vertical axis substantially  
perpendicular to a longitudinal axis of said land vehicle.

10 18. The system according to claim 1, wherein at least one of said moving  
elements changes the elevation of said weapons.

15 19. The system according to claim 1, wherein said weapon moving  
mechanism changes the height of said weapons above a roof of said  
land vehicle.

20 20. The system according to claim 1, further comprising a stabilization  
system coupled with at least one of said weapons, said stabilization  
system stabilizing the orientation of said at least one weapon,  
according to the position of a target, and according to the movement  
of said land vehicle.

21. The system according to claim 1, further comprising at least one  
ammunition cartridge coupled with a respective one of said weapons.

22. The system according to claim 1, further comprising at least one communication interface coupled with said weapons, said moving elements, said weapon moving mechanism, said sensing mechanism, and said user interface.

5

23. The system according to claim 22, wherein the coupling of said at least one communication interface with said weapons, said moving elements, said weapon moving mechanism, said sensing mechanism, and said user interface, is selected from the list consisting of:

10

conductive; and

wireless.

15 24. The system according to claim 1, wherein said land vehicle is selected from the list consisting of:

wheel driven;

track driven; and

a combination of the above.

20

25. The system according to claim 1, wherein said land vehicle is an unmanned land vehicle.

26. The system according to claim 1, wherein said weapon moving mechanism moves said weapons between a static firing configuration and a transportation configuration, said static firing configuration having a static firing height with respect to said base mount, said transportation configuration having a transportation height with respect to said base mount, said static firing height being greater than said transportation height,

wherein the elevation in said static firing configuration is characterized by a first range of angles and the elevation in said transportation configuration is characterized by a second range of angles, and

wherein said first range of angles is greater than said second range of angles.

15 27. The system according to claim 1, said base mount is coupled to an outer surface of said land vehicle, without substantial modification to said outer surface and without penetrating said land vehicle.

20 28. Land vehicle weapon system according to any of claims 1-27 substantially as described hereinabove.

29. Land vehicle weapon system according to any of claims 1-27  
substantially as illustrated in any of the drawings.

For the applicant  
BOROCHOV, KORAKH, ELIEZRI & CO.,  
Advocates & Patent Attorneys

By: 

Eliav Korakh, Advocate & Patent Attorney

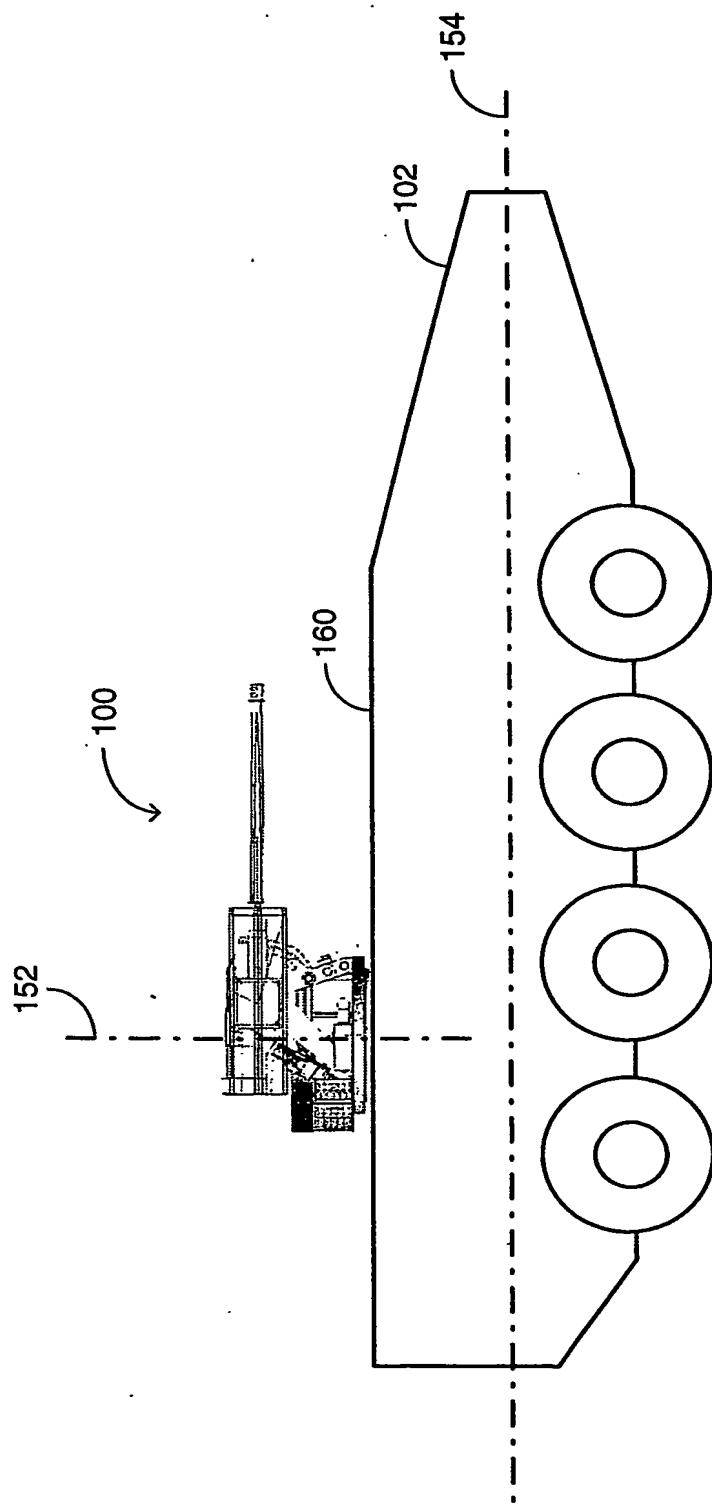


FIG. 1

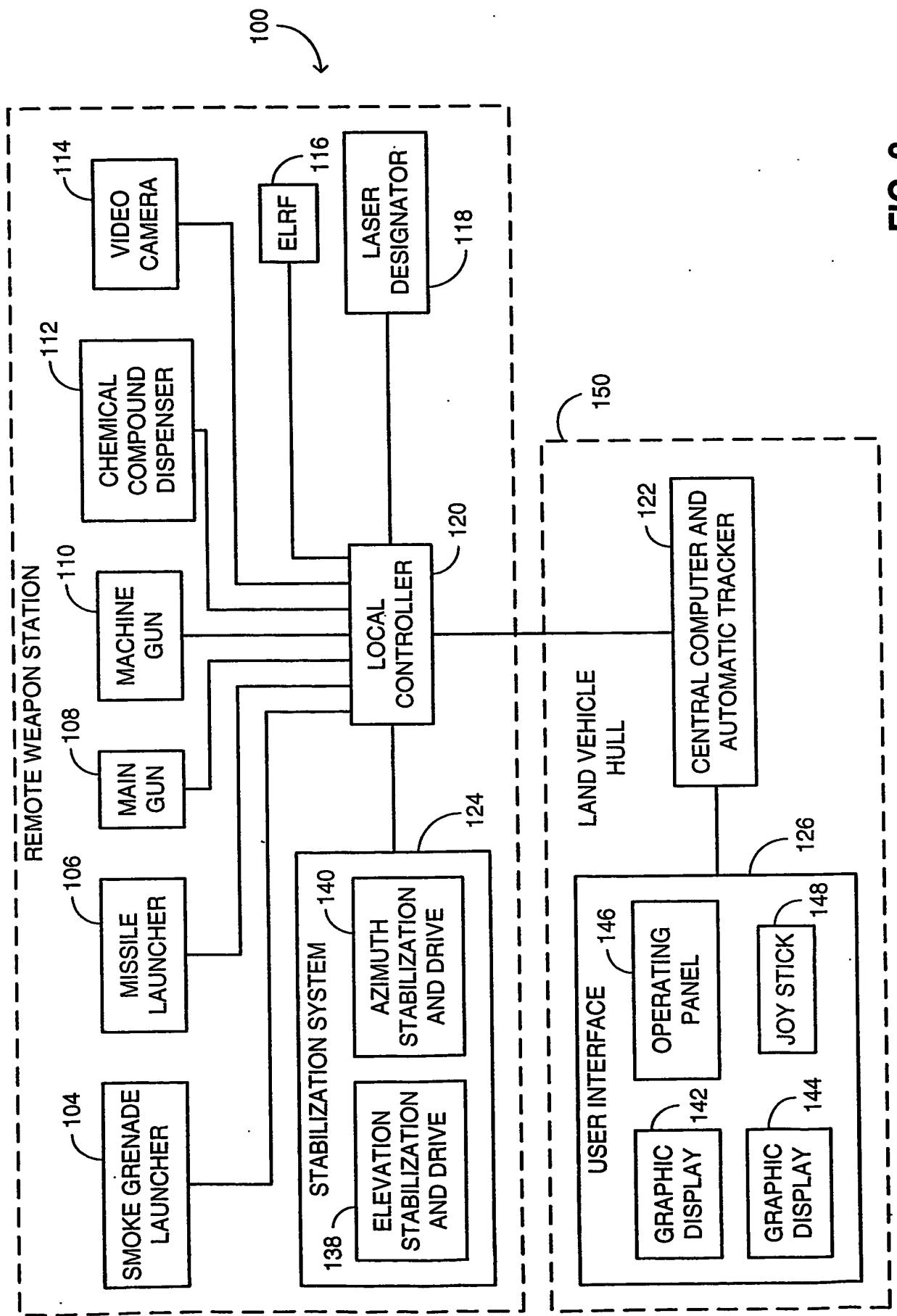


FIG. 2

FIG. 3

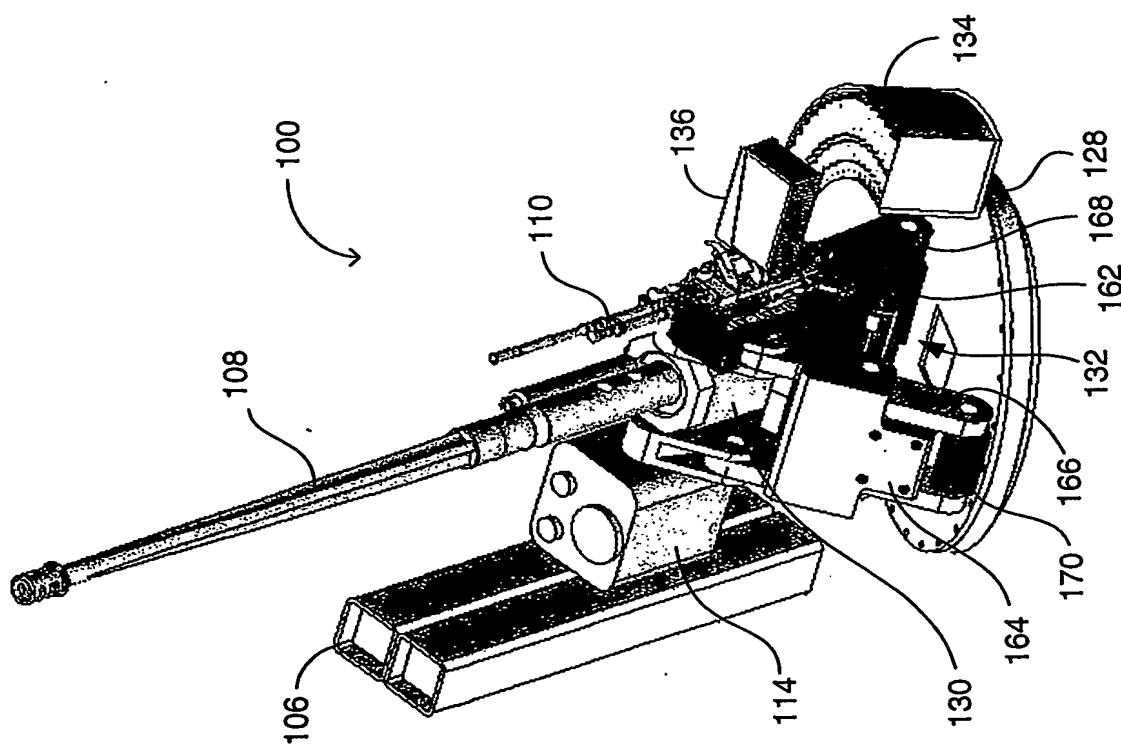
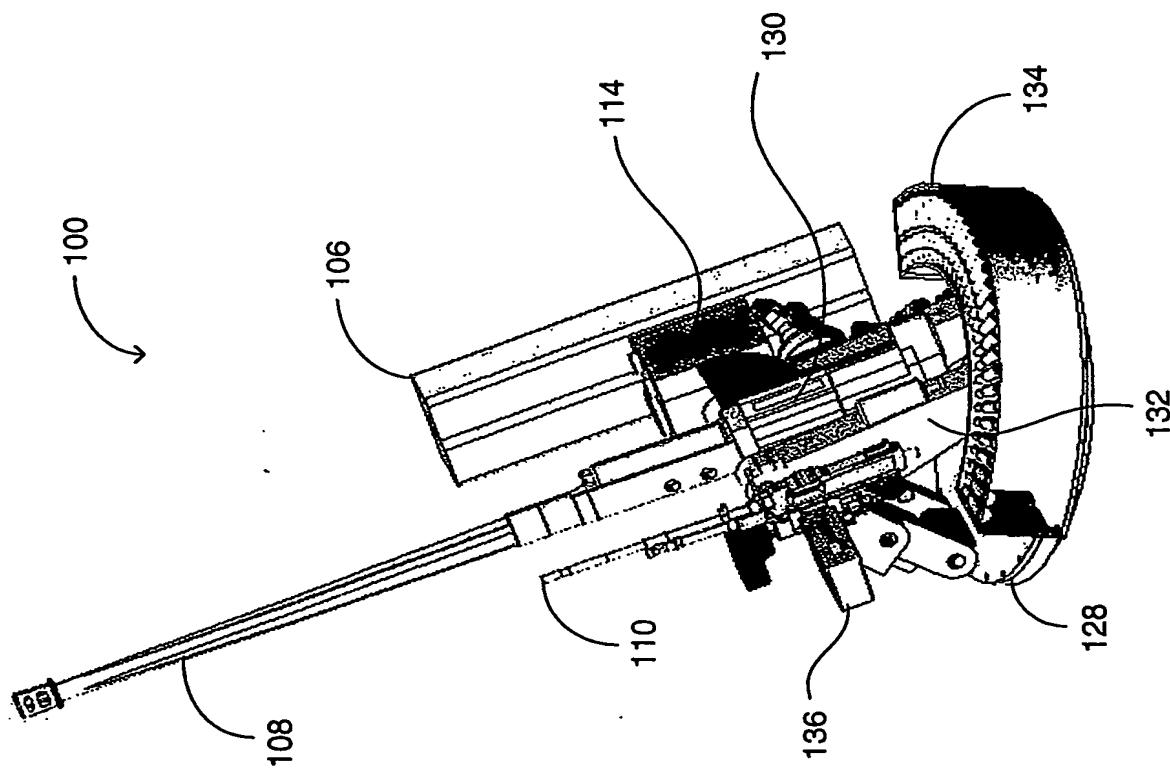


FIG. 4



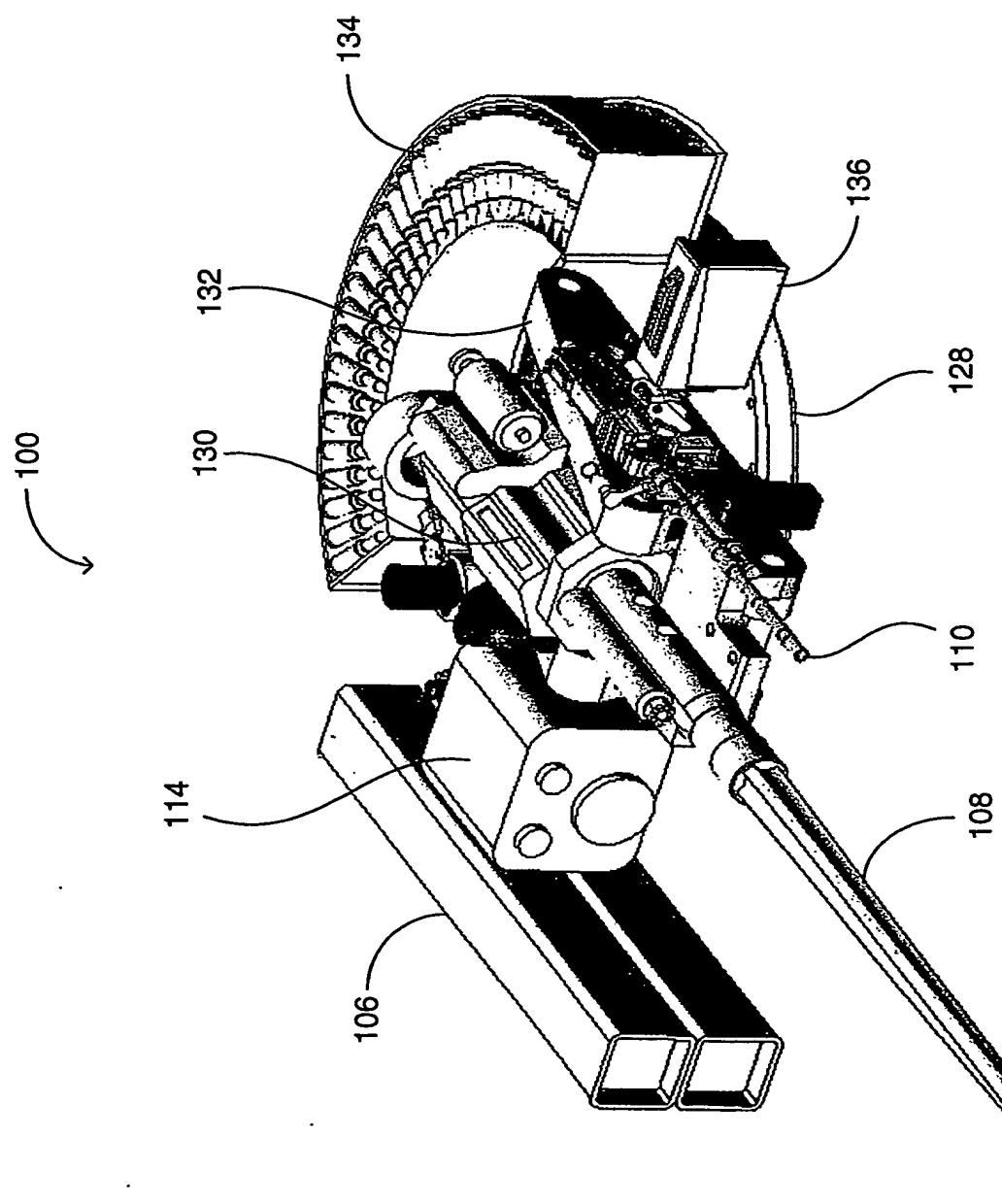


FIG. 5A

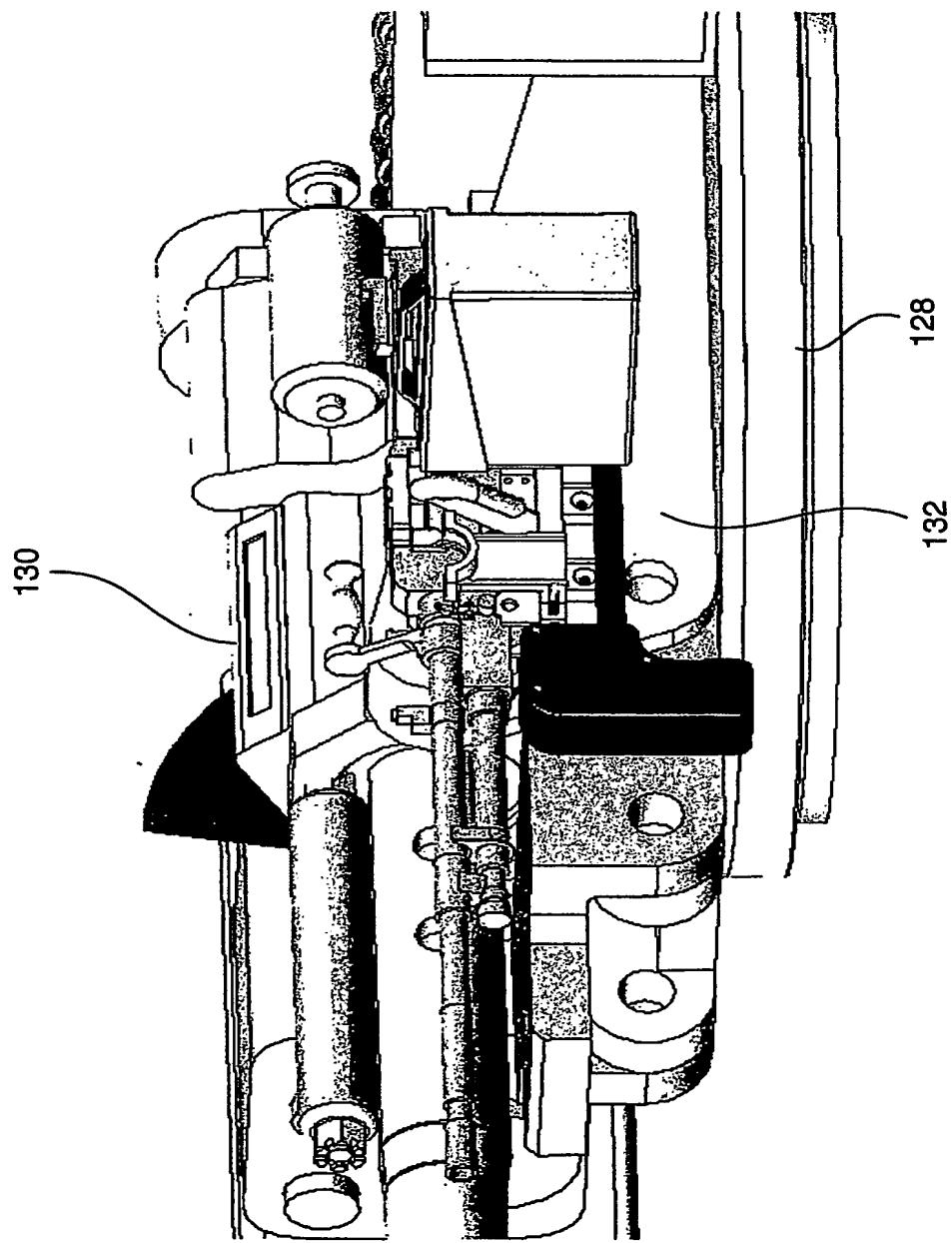


FIG. 5B

FIG. 5C

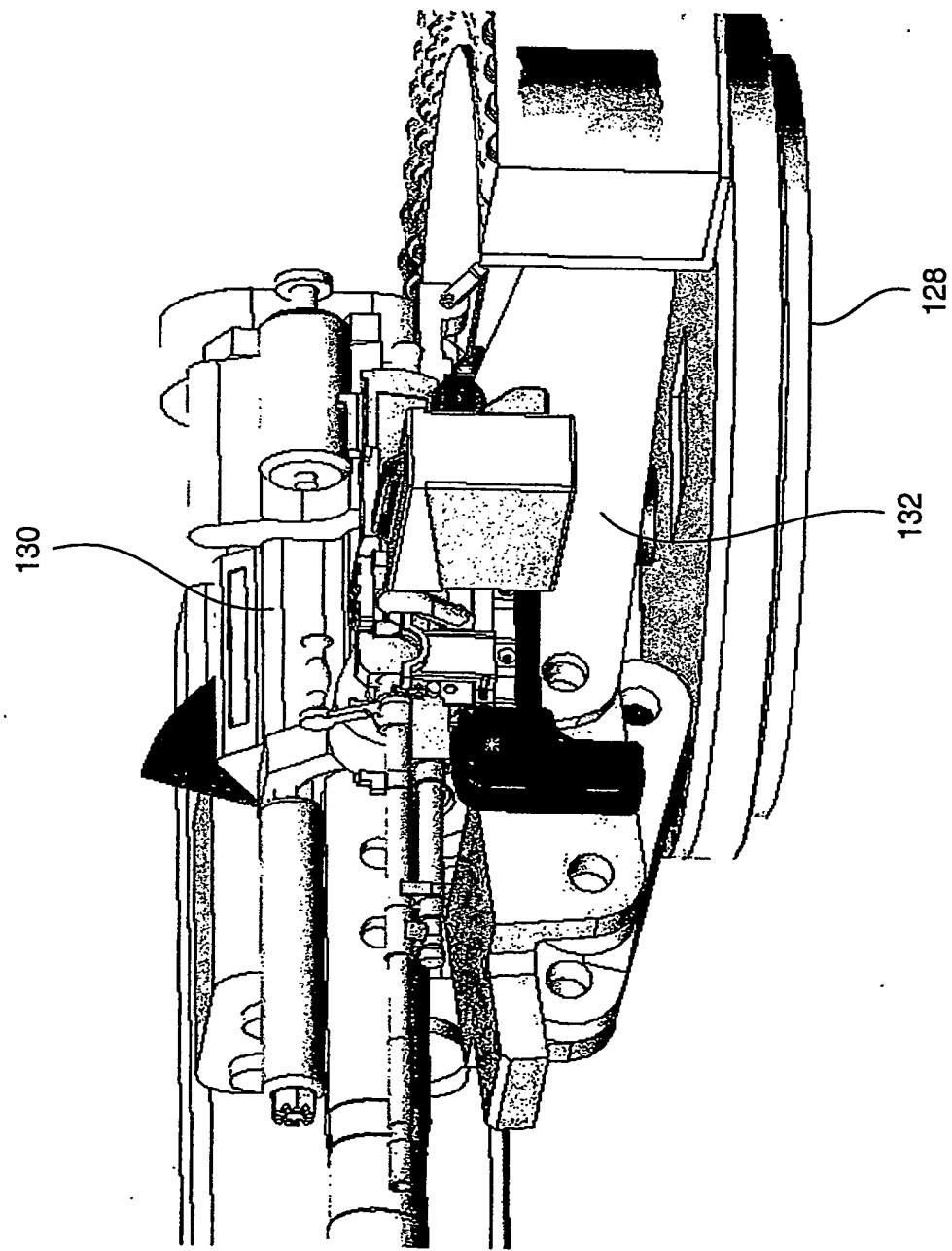


FIG. 5D

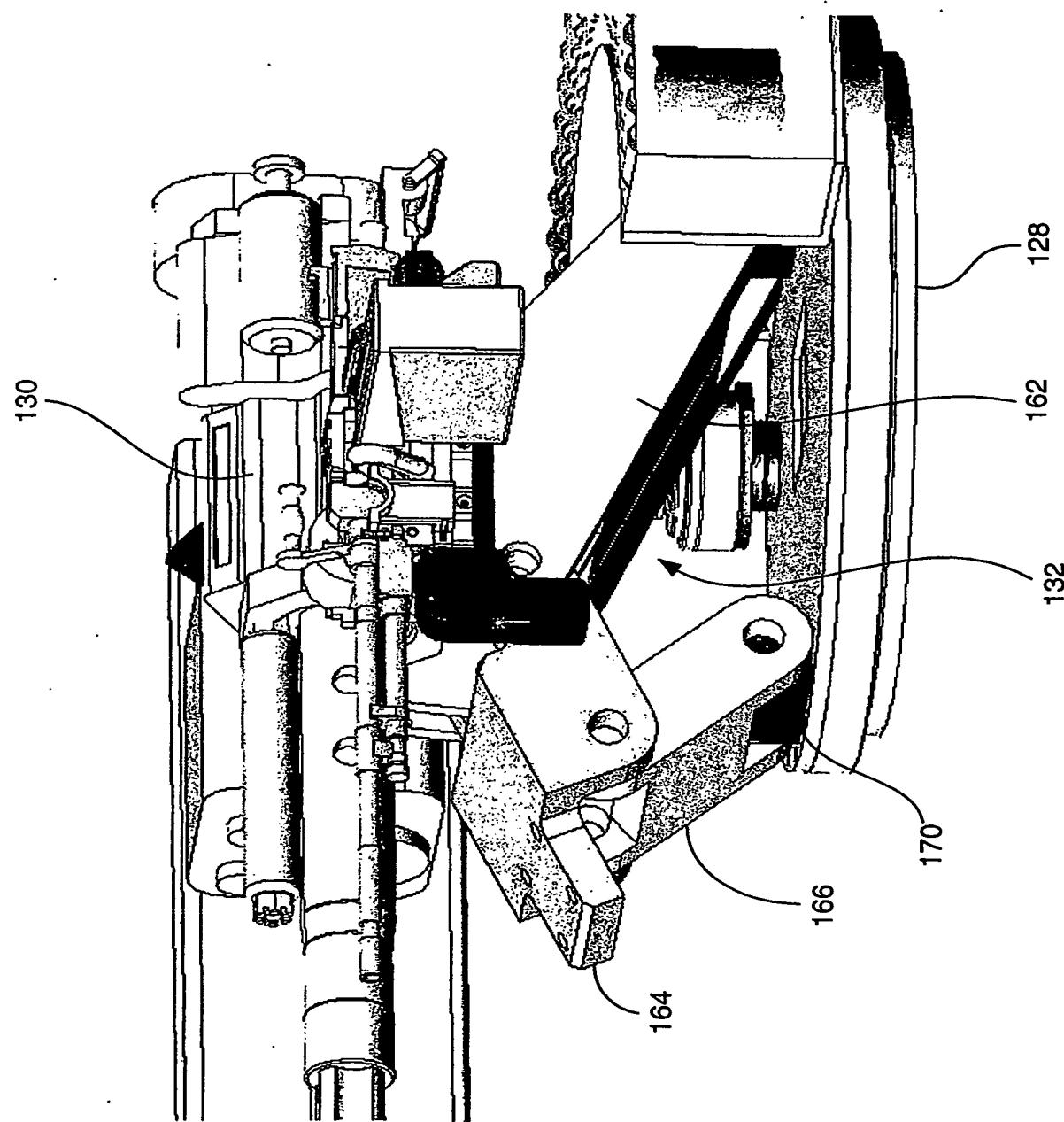


FIG. 5E

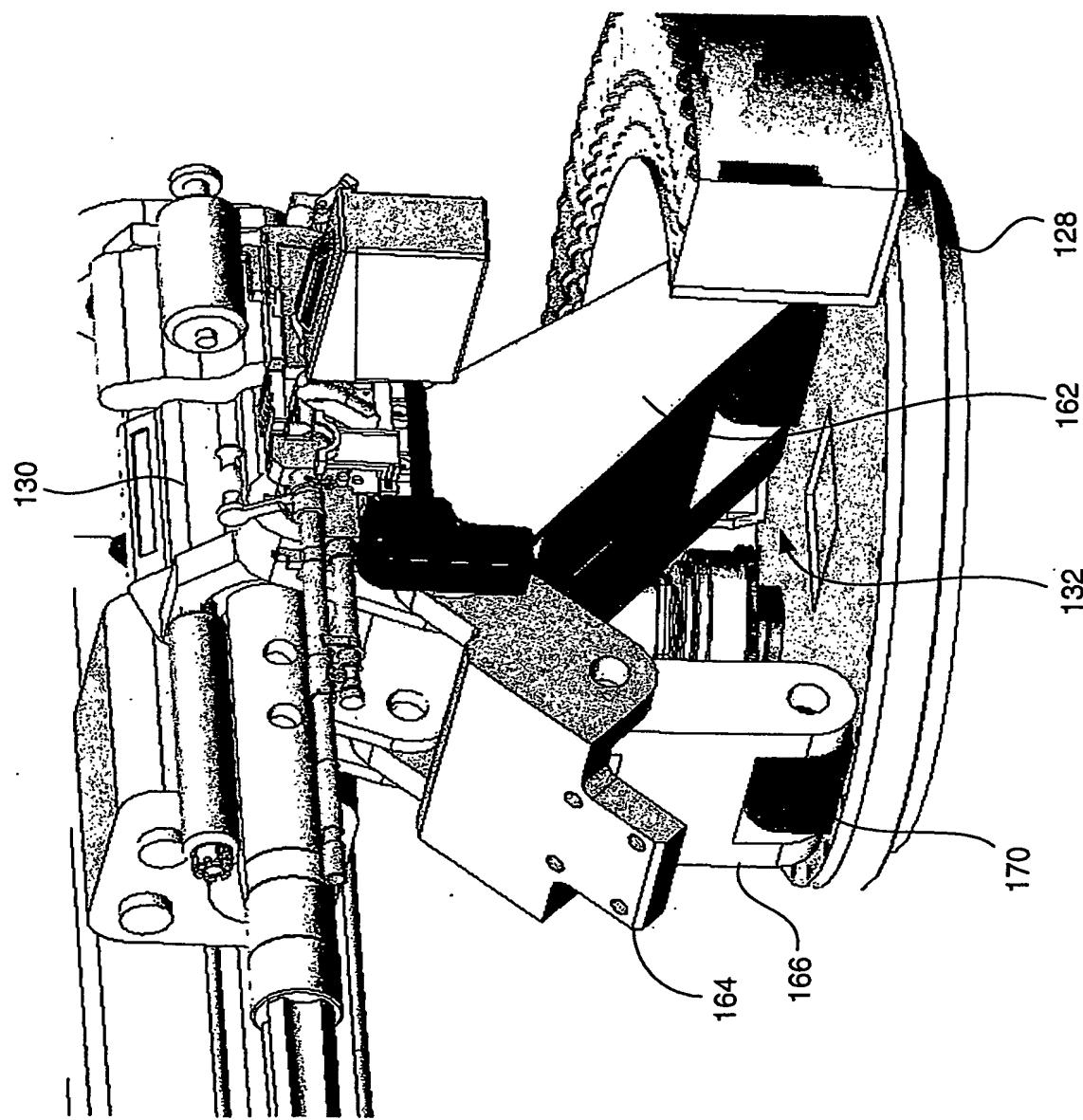
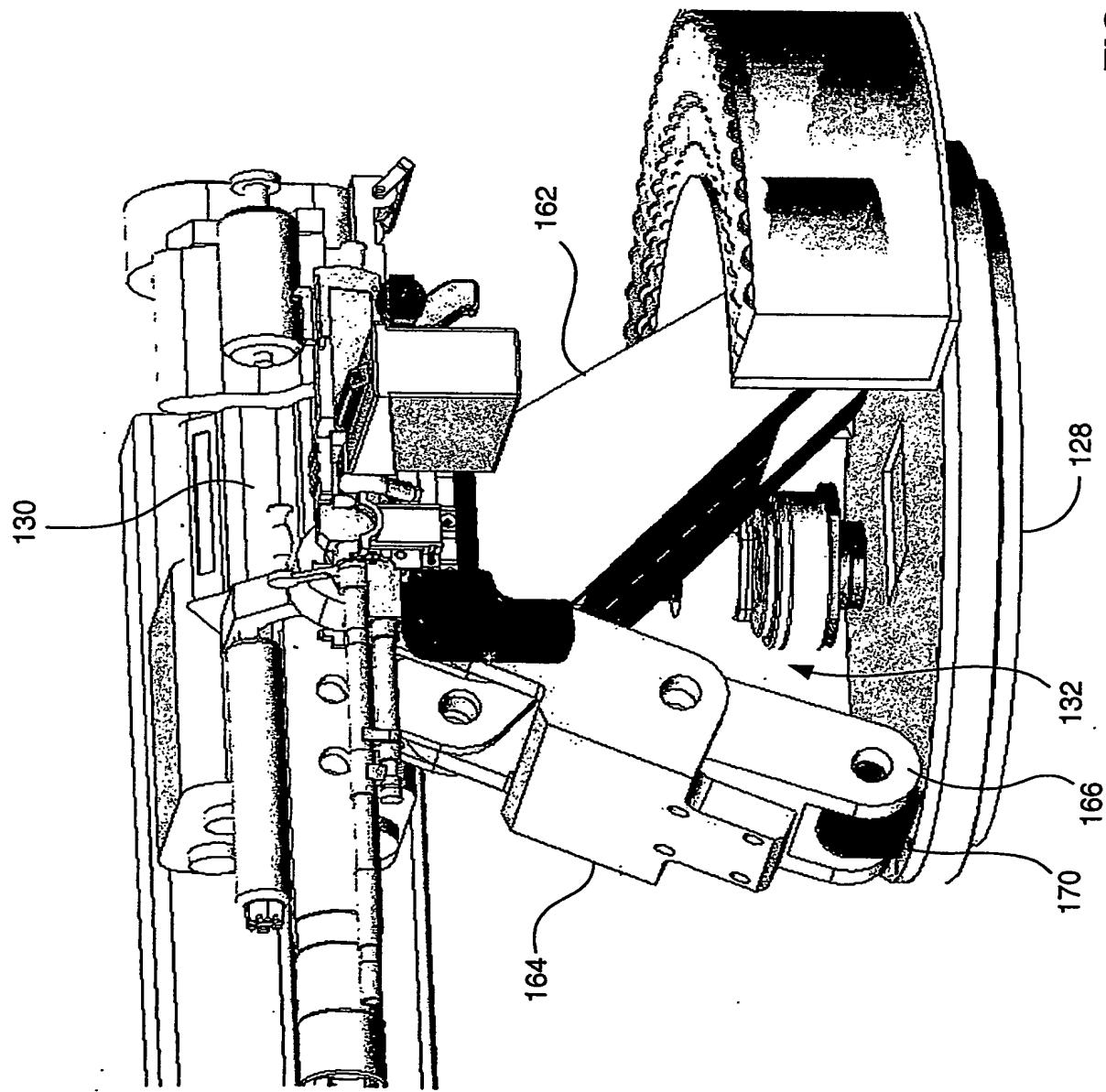
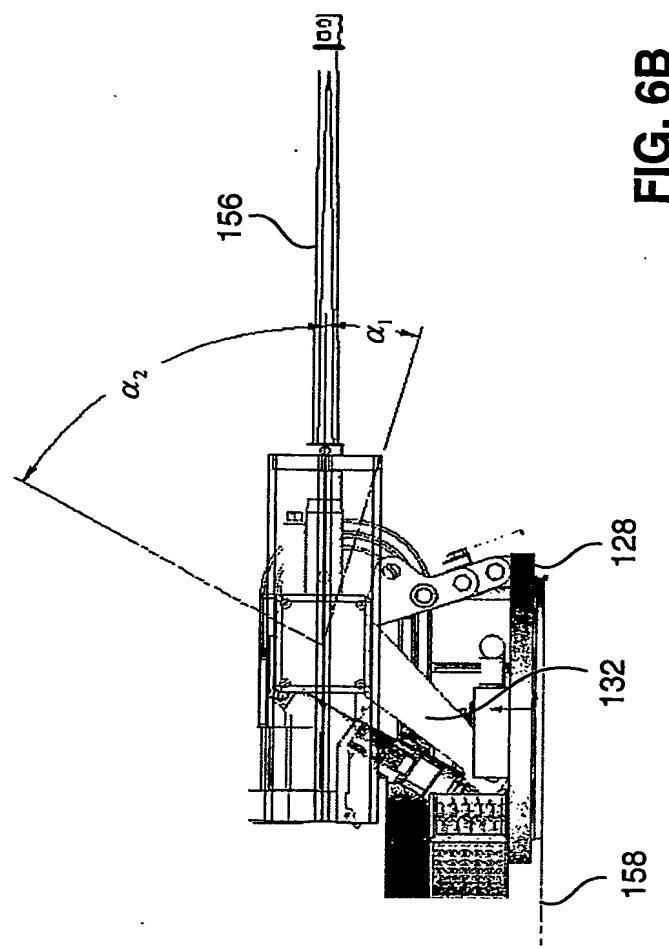
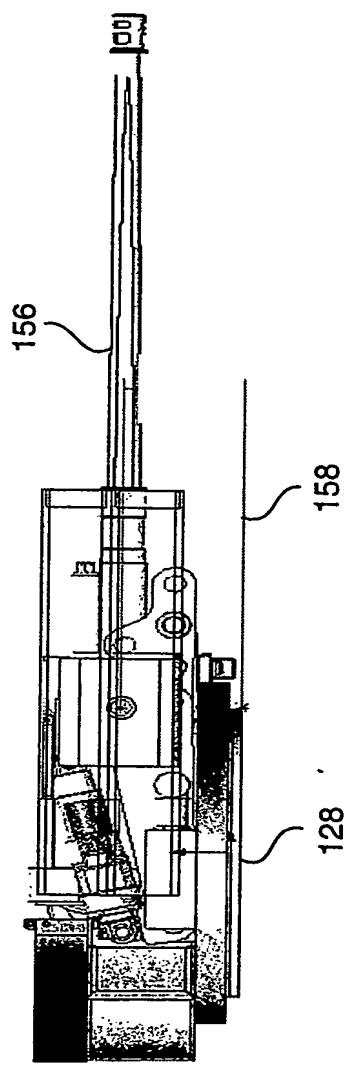


FIG. 5F





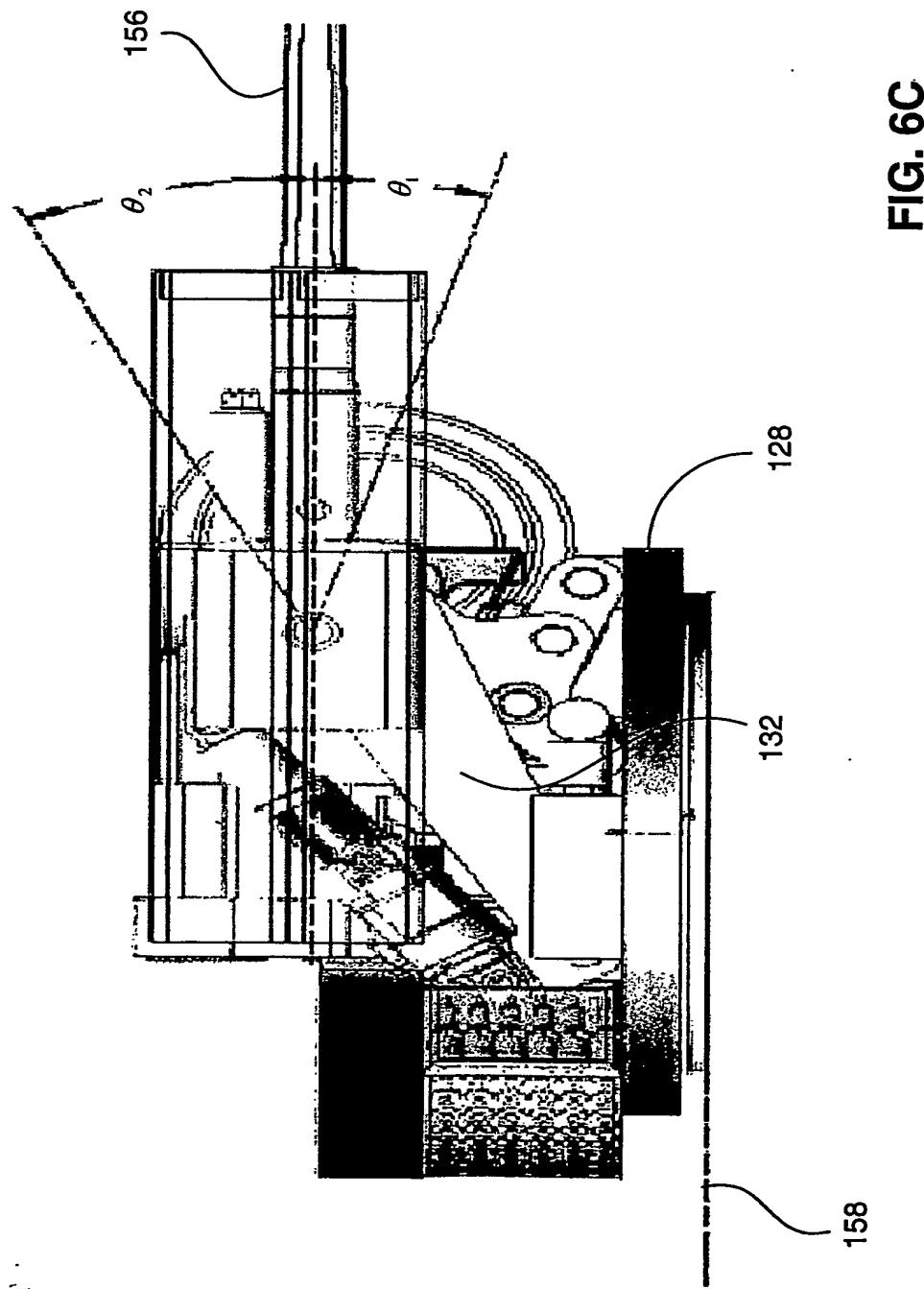
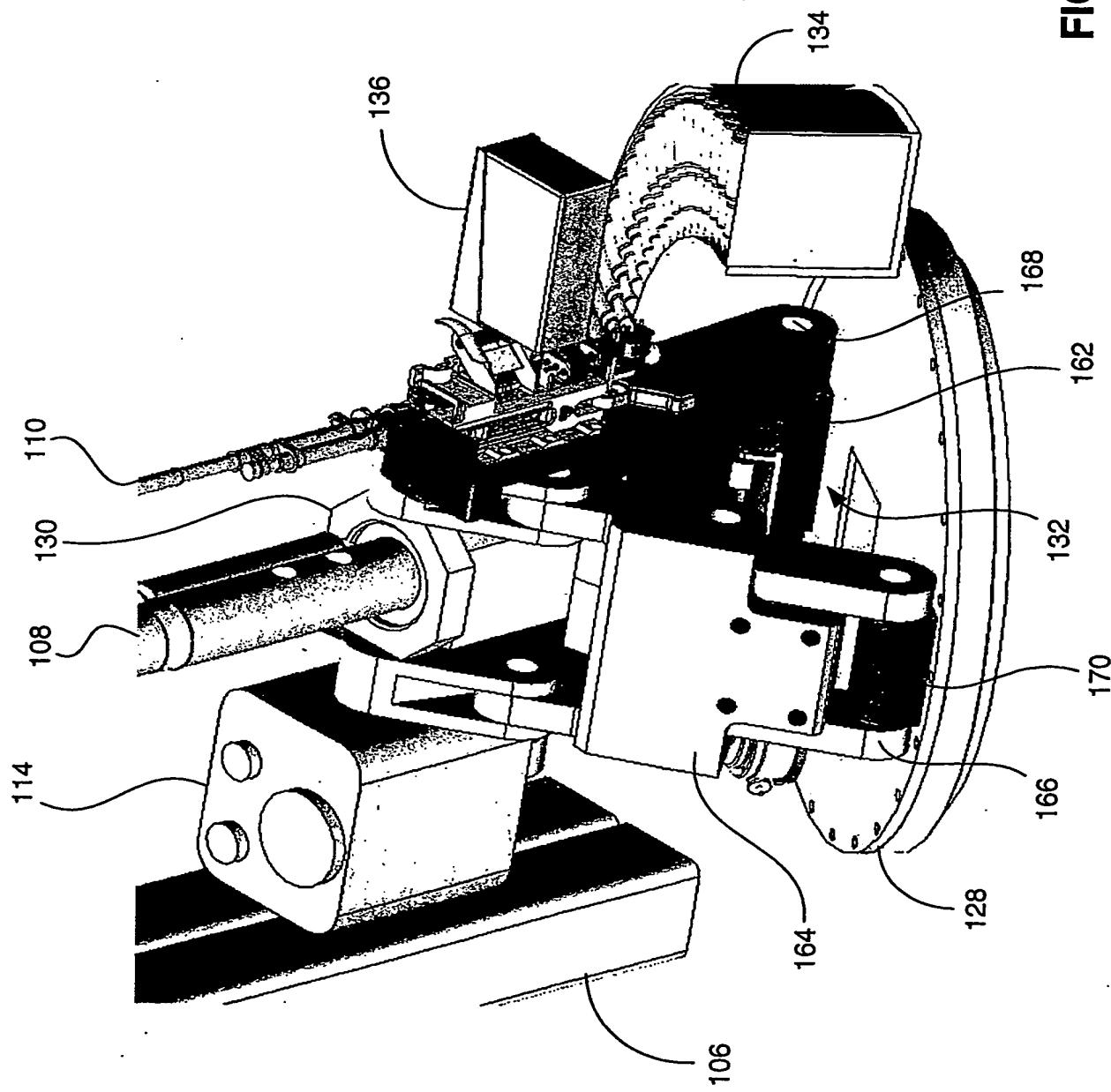


FIG. 7



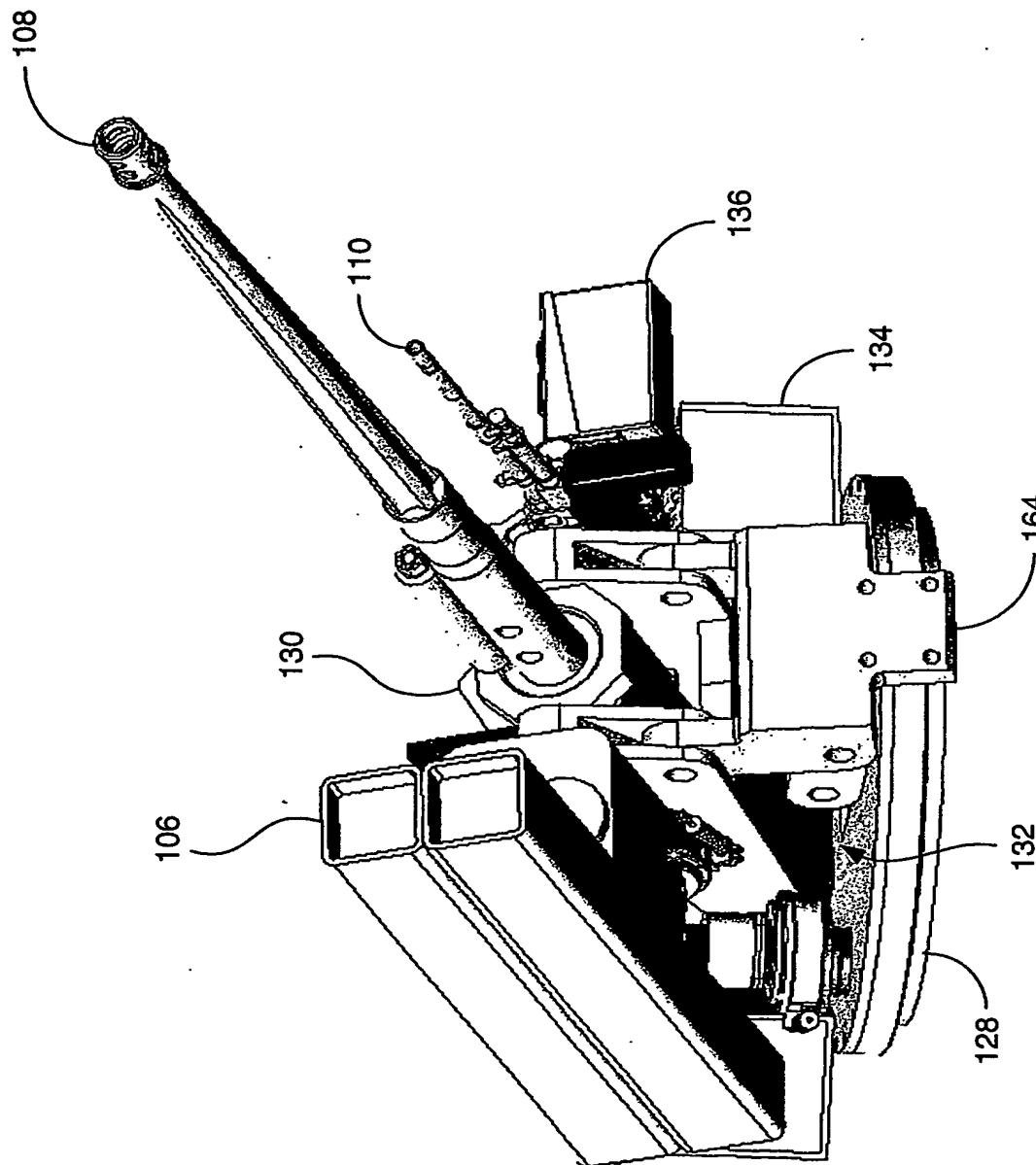
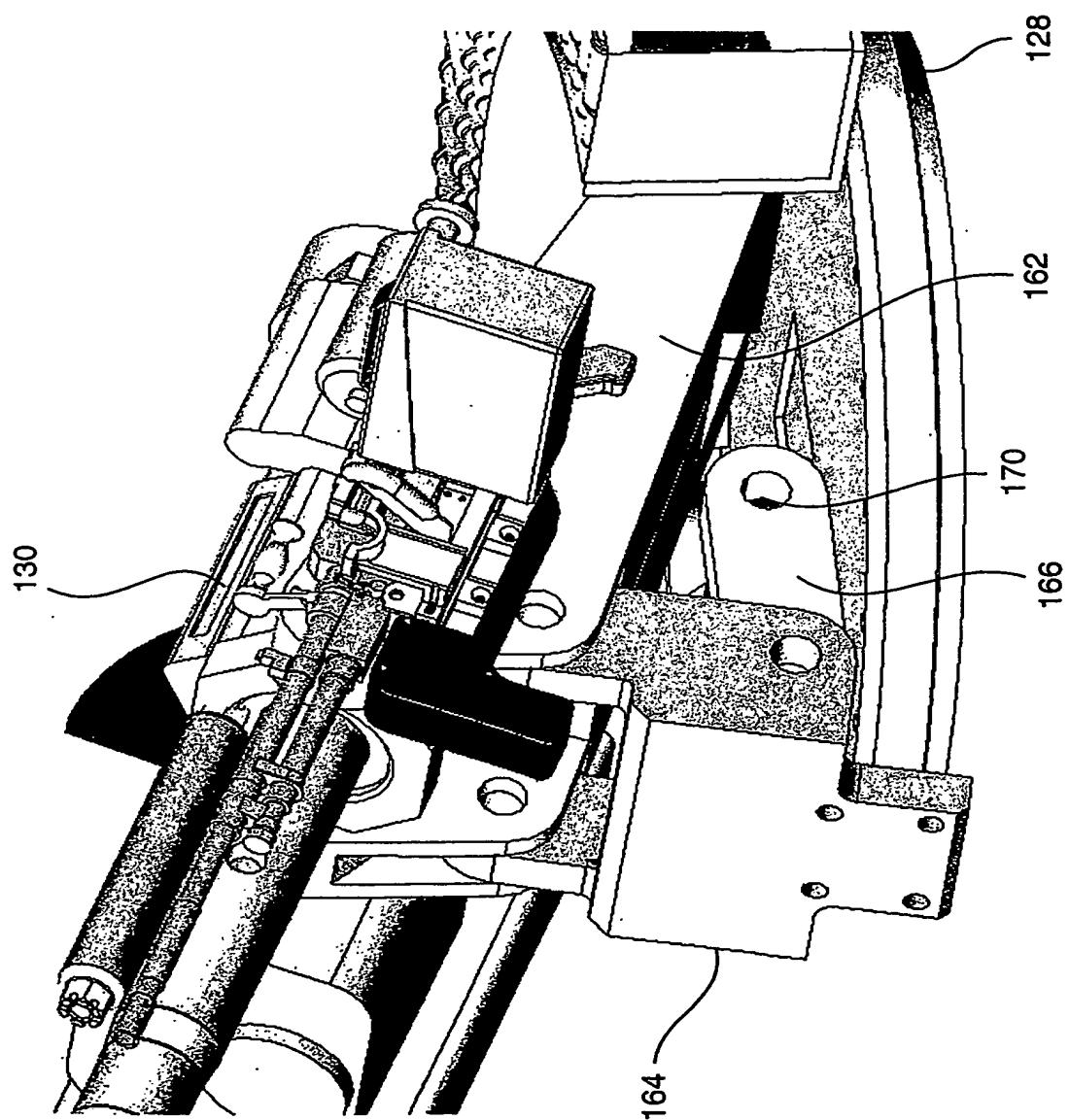


FIG. 8A

FIG. 8B



# Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/IL04/000918

International filing date: 05 October 2004 (05.10.2004)

Document type: Certified copy of priority document

Document details: Country/Office: IL  
Number: 161487  
Filing date: 19 April 2004 (19.04.2004)

Date of receipt at the International Bureau: 23 November 2004 (23.11.2004)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland  
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**